SCIENCE

NEW SERIES
VOL. LI, No. 1328

FRIDAY, JUNE 11, 1920

SINGLE COPIES, 15 CTS.
ANNUAL SUBSCRIPTION, $6.00

New York State Institute for the Study of Malignant Disease

113 High Street, Buffalo, N. Y.

Bids are desired on anhydrous radium bromide containing fifty to seventy per cent of radium element. The impurity should be barium chloride. The salt should be thoroughly dehydrated from its water of crystallization. It should contain less than one-tenth of one per cent mesothorium. Dealings are not desired with agents and bids must be received direct from manufacturers. Payments will be made on certification of the Bureau of Standards and the price quoted should cover payment of the fee of the Bureau of Standards for this work. Bids should state time of delivery and price per gram on one, two and three grams of the element or fractions thereof. A bond will be required for the proper enforcement of the contract. Sealed bids should be sent to the Director, New York State Institute for the Study of Malignant Diseases, 113 High Street, Buffalo, N. Y., and must be received before 12 Noon July 1st, 1920, when bids will be opened.

SCIENCE

FRIDAY, JUNE 11, 1920

CONTENTS

MSS. intended for publication and books, etc., intended for review should be sent to The Editor of Science, Garrison-on-Hudson, N. Y.

THE FUTURE OF THE STATE ACADEMY OF SCIENCE[1]

IN SCIENCE of December 5, 1919, Mr. D. D. Whitney presents certain data and conclusions on State Academies of Science. Omitting mention of a number of large academies centering in cities his figures show that membership varies from 25 to 350; that annual dues run from 50 cents to $10; that annual receipts from state or private sources vary from none to $1,500, 9 out of the 18 enjoying such receipts; that 4 out of 18 pay their officers salaries, from $75 to $1,000; and that the annual publications by 12 out of the 18 academies contain 50 to 600 pages.

In these academies Mr. Whitney finds great variation as to interest and vitality, comments from the officers being "dead" in three cases, "apathetic" in others, and "very lively" in a few. Assigning grades to indicate the various degrees of health and vitality, we may say that of the eighteen academies considered, two would be graded A or "superior"; one B, or "good"; eight C, "passing"; four D, "poor but passing"; and three E, "failure." This result seems to follow the probability curve fairly well, and should perhaps cause us to look upon the situation with some complaisance. It might be unreasonable to expect all of the group to come up to the highest standard of excellence.

Our own academy is reported as having 96 members, no annual state appropriation, no salaries for officers, no annual publication, and as manifesting an interest "fairly lively." This ranks us as of about C grade, passing but without distinction. Our growth, however from 46 charter members in 1914 to 110 members in 1920, indicates a persistent vitality, and the classification of our membership, 25 per cent. of our resident members being un-

[1] President's address before the Kentucky Academy of Science, Lexington, May 8, 1920.

connected with educational institutions, shows that we are to a small extent at least "unifying the scientific interests of the State."

Mr. Whitney takes a somewhat somber view of the future of the state academies. He points out the fact that only a small percentage of the scientific men and women of the states are affiliated with the academies, explaining the fact by the existence of larger societies for specialists which appeal more strongly than the local academies with this lack of differentiation. However, he mentions two advantages of the state academy; the opportunities for social intercourse and good fellowship which tend to encourage scientific effort in smaller colleges and normal schools; and the provisions for the publication of articles that would not be accepted by the larger and more important periodicals. To these we should add the practise of bringing to the annual meeting some outstanding scientist who otherwise might not come before our membership.

This article suggested to the writer that it might be well to ask the secretaries of these academies certain questions with a view to determining if possible a little more definitely whether there is a field and a future for the state academy, and in particular for the Kentucky Academy. Accordingly a series of questions was proposed, the first of which was whether, in view of the large number of national and regional scientific societies there is any need for a state academy. Mentioning the replies from state academies only the vote stood: Yes, 9; No, 2. These two negative votes were, curiously, one from a very active academy centering in a large city, and one from a state academy reported by Mr. Whitney as showing lively interest at the annual meeting but apathetic the remainder of the year. We may say however that most of those reporting, whether lively or moribund, wish still to live and claim for themselves a *raison d'etre*.

The second question asked was "What are your reasons?" First let us notice the reasons of those who vote against the state academy. We are told that the academies are not needed because a state does not seem to be a convenient unit for scientific organization; because the interest in the academies is very small; because the publications are mediocre, no one being willing to publish their good articles in the *Proceedings* for fear that they will never be seen; because the social value is the only real value and that is not sufficient justification for the work entailed; and because the professional men and every one else have their own societies in which they are much more interested.

But the affirmative argues that the academies have a field and are needed, because their meetings are so near home that scientists of the state can get together; because a large number of the members are young people who are not yet, and in many cases never will be, ripe for membership in the national societies, but who can be greatly stimulated by the academy activities; because the society brings together scientists of varied interests, there being too much subdivision and segregation in the scientific field at present; because they bring men not connected with educational institutions in touch with scientific matters; because they give opportunity for papers of local interest which would not find place on the programs of national societies; because they foster state pride and interest in state welfare; because they bring to bear a certain amount of influence for the betterment of the state; because, except in the field of chemistry, they are about the only local scientific societies that emphasize research rather than education; because they exercise a tonic effect in the life of the state and foster a proper appreciation of the value of science; and because they supply a needed element of organization in the scientific field which the national societies do not afford.

With the feeling that, valuable as is the annual meeting of the academy, there should be some larger service possible in the interests of science and the state, a third question was asked for information regarding other activities. Of the eleven academies being quoted, four did nothing beyond the annual meeting, ex-

cepting in some instances, the publication of the annual proceedings. Other answers were that the secretary sends out letters to find out what is going on in the way of science advancement; that an annual expenditure of $250 is made in grants for the encouragement of research on the part of members; that a library and exchanges are kept up; that various sections hold meetings throughout the year; that a second meeting of the academy is held; that an out-door "excursion meeting" is held, usually for two days, when members ride, tramp, camp, do field-work and get better acquainted; and that a number of committees are working on various problems of value to the state. This last comes from Illinois, where the academy has a committee on the Ecological Survey of the State, organized now for ten years; a Committee on Science Education; a Committee on Legislation as affecting Scientific Interests; and a Committee on Conservation of Wild Life in the State.

Omitting other questions asked of the academies the last should be mentioned, namely, "What new forms of scientific service might the Academy undertake?" Here we run against the very general handicap of lack of funds. Many things might be done if only the necessary money were available. The need is felt of more money for publication, more money for research funds, more money for surveys. But a number of other suggestions are made. The academy might become more influential as an adviser in connection with legislation affecting the natural resources of the state. The work of science should be more closely correlated with the industries of the state. More effort should be spent on the problems of development of the natural resources of the state on a firm scientific basis. The members should be stimulated to study and report on many subjects of state or local interest. Local chapters should be formed. State surveys in botany and zoology and geology should be organized and allotted to various members. High-school teachers should be brought in to the academy for the sake of better science in the high schools. Science clubs should be organized in the high schools, these clubs to be affiliated with the State Academy.

These ideas should prove exceedingly suggestive to us in Kentucky. No state in the union offers a richer opportunity for the efforts of an energetic and progressive Academy of Science. It would be a reflection upon your intelligence to argue the point that the war just closed has proved the value and the need of science. Scientific achievements threatened civilization with destruction, and science was an essential in the salvation of the world from barbarism. No civilized nation will henceforth be so criminal as to neglect the deliberate, systematic, organized effort to develop science in the interests of national defense and domestic welfare. This essential importance of science was recognized by scientists long before the war, if it was not by the general public. But scientists themselves apparently had not realized the necessity for organization and cooperation in scientific effort as well as in government and in industry. This perhaps is the outstanding fact before our minds to-day. We saw the forces of science hurriedly and effectively classified and grouped and directed under the leadership of the National Research Council during the war. In peace we are now seeing the same idea carried out in the organization of International Associations, in the present-day program of the National Research Council, which contemplates the permanent coordination of the scientific work of the nation, and in the enlarged program of the American Association for the Advancement of Science. Both the Council and the Association propose to reach down and touch local scientific interests through the state academies.

In this fact we find an immediate and conclusive reason for the continuance of our State Academy. No organization can be complete without its subordinate units, nor can the scientific interests of the nation be completely fostered and directed without state and local groups. In the army must be brigades and regiments and battalions and companies and squads. The state academy

furnishes the necessary subdivision for the effective marshalling of the nation's scientists.

This being agreed to, it follows logically that the state academy should proceed to organize local chapters for the completion of the system. The greatest need now is not more national societies but a more thoroughgoing organization of state and local scientific forces. We have already seen that in Illinois an effort is being made to stimulate the formation of science clubs in the high schools and to interest high school teachers in the work of the academy. Our Academy has a goodly percentage of its members among scientists not connected with educational institutions. What is needed is that this membership be greatly extended and organized into chapters so that every large industry and even the smaller establishments will be brought into touch with the academy and through it coordinated with the national organizations. The academy will thus include in its fold both those who love science for its own sake and for the extension of knowledge and also those who are using science for the furtherance of industry and the material advancement of man.

But the academy finds justification apart from its usefulness as a subdivision in the great national organization in that it can serve its own state in many distinct directions. Many lines of possible service have already been suggested in the summaries of the questionnaires, but it will be worth our while to think a little farther concerning some of them. Isolation is one of the most serious handicaps to research, although it can doubtless be shown by examples how certain great constructive geniuses have lived their lives in seclusion and by the sheer power of intellect brought to light important additions to human knowledge. Many have found the needed contact in correspondence and publications. But for the average scientist whose number is legion and whose aggregate contribribution to progress is large, the stimulus of human association, and the spur of close contact with kindred minds are indispensable. We can not depend entirely upon the large universities nor upon the large industrial establishments for our scientific life. There will always be able men in the smaller colleges and schools and in the smaller establishments who must have opportunity for contact and mutual inspiration and suggestion to enable them to produce their maximum effort and stand as missionaries in the cause at home. The academy must supply to all scientific workers in the state this desirable contact and mutual helpfulness.

Selfishness and secretiveness and suspicion in research, individualism must now give way to coperation for the sake of the advancement of knowledge and of social and industrial progress in the state. Scientists have much to learn in this respect from statesmen and business men. Men do not greatly increase their wealth by hoarding; they do not make most in small private businesses; they do not win wars by "sniping," they do not destroy threatening social iniquities by individual blamelessness. Efficient machinery directs and multiplies power, increases speed.

The academy should come to be a source from which any man in the state who needs help along scientific lines may draw what he needs. If for instance a worker in some small or large industry of the state feels the need of consultation or advice he should come to look upon the academy as the proper organization to which to apply. The academy through its officers or special committees should be in a position to answer his questions or to direct him to those of its members best fitted to render aid. An instance to the point is that of a research chemist in a large drug manufactory who was enabled to complete a three year research which had failed of reaching a definite result, by means of a hint from a university worker. In our own state many such cases of helpfulness will arise if we can bring our academy to the point where it will be regarded as the natural place to which to come for information as to facts and men.

The organizers of the academy six years ago had in mind the possible usefulness of the academy as an adviser in legislative matters affecting scientific interests when pro-

vision was made in the constitution for a standing legislative committee. This committee was appointed for a number of years, but gradually sank into "innocuous desuetude" through lack of effort or of opportunity for rendering service. The question now arises whether the present, when all things are being made over, when all institutions and societies are feeling the new impulses furnished by the war, is not the proper time for a rejuvenation of this committee. It is safe to say that the academy in the past has not at all impressed itself upon the attention of our legislatures nor our citizenship and that outstanding usefulness will come to such a committee only after years of steady growth in the size and activity of the academy. The time to begin however is now, and the way to gather to itself influence and authority as an expert adviser is to begin first with a thorough study of local scientific problems and to put before the public in speech and print definite facts and recommendations. No other opportunity for extension of academy activity and service seems more fertile in possible good than this. Not even the State University, which stands before the public in a peculiar sense as the guardian of state scientific and industrial interests, can appeal to all elements in the state as a disinterested and representative source of expert advice as can the Kentucky Academy. There is distinct need for such a force in the life of the state and the academy must not prove false to her mission nor neglect her manifest opportunity by failure to assume the responsibility of leadership.

Many problems face us in Kentucky that will need the keen interest and intelligent cooperation of the especially qualified membership of the academy. In this last legislature there arose a rather minor question the handing of which well illustrates how valuable can be the man who knows. A bill was proposed which placed a bounty on hawks and owls, the idea being that without exception all such birds are pests, killing quail and chickens with ruthlessness and dispatch. The bad science back of such a bill was discussed in one of our societies at the university and word was sent to the committee considering the bill that the bill threatened injustice to a large class of desirable bird citizens. As a consequence two members of the Legislature paid a visit to one of our professors for the purpose of getting information, and were quickly convinced that only the Cooper's hawk is depraved while all the others are useful in that they kill rats and other undesirables. This incident calls attention both to the value of expert testimony and to the prevailing lack of scientfic treatment of problems affecting many people and widespread social and industrial interests. In our hap-hazard, hasty, self-confident, irresponsible law-making, certainly some organization should stand out before the public as a source of sane reliable and unbiased scientific information.

There is great need for scientific direction and propaganda for the preservation of bird life, for the proper appreciation of their economic importance. Only last Tuesday one of our professors stated before the Audubon Society that the bird population of the state and nation had been reduced approximately 50 per cent. in the last 15 years; and that the causes were, next to cats, the destruction of our woods and forests. And yet, he said, birds are the greatest weapon of the farmers against crop-ravaging insects.

There is pressing need that wise research and public education be devoted to the problems of forestry. Many problems of forestry must be solved if the forests are to continue adequate and the supply of lumber be on hand for succeeding generations of men. The mineral resources of the state present problems that must be the concern of all properly qualified scientists of the state. The preservation and development of our water-power resources demand intelligent survey-work, persistent public education and authoritative advice to our legislatures. The growing of tobacco has reached such proportions in the state as to affect the well-being of large numbers of citizens. It is not the part of

wisdom to banish all study of the growing and marketing of tobacco because of a dislike for the weed and disapproval of its use; but rather for all so qualified to unite in a program of research and education that will conduce to the improvement of the human elements involved. The preservation and promotion of human health is a matter of "vital" concern to every citizen, and there is abundant need and opportunity for a representative state scientific society to exert its strength toward the conservation of vital resources.

It is not being urged that the academy should attempt to take over the work of the experiment station or of the private laboratory. That of course would be ridiculous. Rather, the academy should be a medium through which men in various parts of the state and in various educational and industrial plants may be associated in the furtherance of needed scientific endeavor. Such a medium will bring all men in touch with problems of research in which they may be fitted by training and location to take a part in problems too large and complex and requiring too many phases of scientific treatment for one man to handle. We may well imagine for instance that officials of the National Research Council, wishing to find qualified men in certain parts of Kentucky to carry on locally a certain part of some large piece of research will come to the Kentucky Academy for information and advice as to men. Such an organization should be in a position through its officers and committees to speak with authority and conviction upon all matters of scientific importance in the state, bringing to bear upon public opinion the weight of disinterested scientific unity. Certainly such an active and influential academy would stimuate research in Kentucky and the whole South, render valuable aid in assignment of problems and the placing of men, and guide public opinion into the proper understanding of local scientific matters.

Our study has led us to feel a firmer faith in the mission of our Kentucky Academy. From her modest past she may yet arise to grand proportions of influence and usefulness. To that end let us adopt a program commensurate with the spirit of the times.

First, let us cooperate heartily with the national bodies seeking to organize the scientific forces of the country.

Second, let us actively seek to extend our membership to every educational and industrial plant in the state, and to every scientist, and exert a scientific leadership throughout the state.

Third, let us promote the organization of science clubs in our secondary schools and of research clubs in various centers.

Fourth, let us bring our influence to bear upon the problem of better science teaching in the high schools.

Fifth, let us appeal to the next Legislature for liberal publication funds, and to the public for research funds to be used in support of local scientists.

Sixth, let us through appropriate committees undertake the study of definite scientific problems of importance to the state, and promote the scientific surveys very much needed.

Seventh, fortified by our especial studies, let us plan to recommend to the next Legislature legislation needed for the scientific interests of the state.

Eighth, let us with faith in our mission and with devotion to the cause make the Kentucky Academy of Science the most influential for good, the livest thing, in Kentucky.

The needs of the day call for such an expansion and such an increase in aggressive effort. We can not live in this good new day and be content with the past achievement. General Foch has said that no battle was ever won by an army on the defensive. To win we must be aggressive.

Paul P. Boyd

University of Kentucky

PRELIMINARY RESULTS OF ANALYSIS OF LIGHT DEFLECTIONS OBSERVED DURING SOLAR ECLIPSE OF MAY 29, 1919[1]

1. TABLE 1 summarizes the available observational data for deriving the amount of deflection of a light ray grazing the sun's limb as observed on the earth. The sources of the data are given in the remarks below the table. No. 2 has been rejected by the British astronomers because of the diffuseness of the star-images on the photographic plates obtained with the astrographic object glass of the Greenwich Observatory used in conjunction with a 16-inch cœlostat, the figure of which apparently changed appreciably during the plate-exposures. It will be observed that the indiscriminate mean results, I. and II., would indicate a value about midway between that (0″.87) computed on the basis of the Newtonian Mechanics and that (1″.74) computed according to Einstein's law of gravitation. If on the other hand the observational results are weighted inversely as the squares of the probable errors, than the weighted mean results, especially IV. (1″.76), are found to be in close agreement with Einstein's value, though the probable error (±0″.2) is still somewhat large.

2. The weighted mean value IV. depends chiefly upon Crommelin's result (No. 3), obtained at Sobral, Brazil, during the solar eclipse of May 29, 1919, from 7 photographic plates, using a 4-inch lens of 19-foot focus and an 8-inch cœlostat, and from similar check-plates obtained at the same station before sunrise between July 12 to 18, 1919. These observations appear to be the best ones for undertaking a critical analysis of the results with the view to ascertaining, if possible, whether any other effect has been measured than that accredited to the sun's gravitational action. The following results of a preliminary analysis, as made by the Department of Terrestrial Magnetism at Washington, are based partly upon data already published in the British journals and partly upon those very courteously supplied by the Astronomer Royal, Sir Frank Dyson, to whom we desire to return our appreciative thanks. The chief purpose of our investigation was to ascertain the possible bearing of the geophysical observations, made by the two chief

TABLE I

Summary of All Observations Concerning Deflection of Light at Sun's Limb

No.	Eclipse	Station	Observers	Deflection at Sun's Limb	Probable Error	Approximate Weight
1	June 8, 1918	Goldendale. U. S. A.	Campbell-Curtis	0″.58	—	1
2	May 29, 1919	Sobral, Brazil	Davidson	0.93	±0″.3	1
3	May 29, 1919	Sobral, Brazil	Crommelin	1.98	±0.12	6
4	May 29, 1919	Île of Principe	Eddington	1.61	±0.3	1
	General results	I. Indiscriminate mean of all		1.28	±0.21	
		II. Indiscriminate mean without No. 2		1.39	±0.28	
		III. Weighted mean of all		1.67	±0.20	
		IV. Weighted mean without No. 2		1.76	±0.22	

Remarks: No. 1 was derived from Dr. Campbell's statement (see SCIENCE, March 26, 1920, page 310) that the mean of their results "came out at 0″.08 or 0″.15, according to which of Einstein's hypotheses was adopted"; the probable error of one star position is given as 0″.5, but the probable error of the mean result is not stated. Nos. 2, 3 and 4 are given in *Monthly Notices, R.A.S.*, Vol. LXX., p. 415, February, 1920. (See SCIENCE, March 26, 1920, p. 308.)

[1] Résumé of papers presented before the American Philosophical Society at Philadelphia (February 6 and April 24), the American Physical Society (February 28 and April 24), and Bureau of Standards at Washington (May 7, 1920). For a general account of observations concerning the solar eclipse of May 29, 1919, and the Einstein effect, the reader may be referred to the author's "Résumé," published in SCIENCE, March 26, 1920, pp. 301–312.

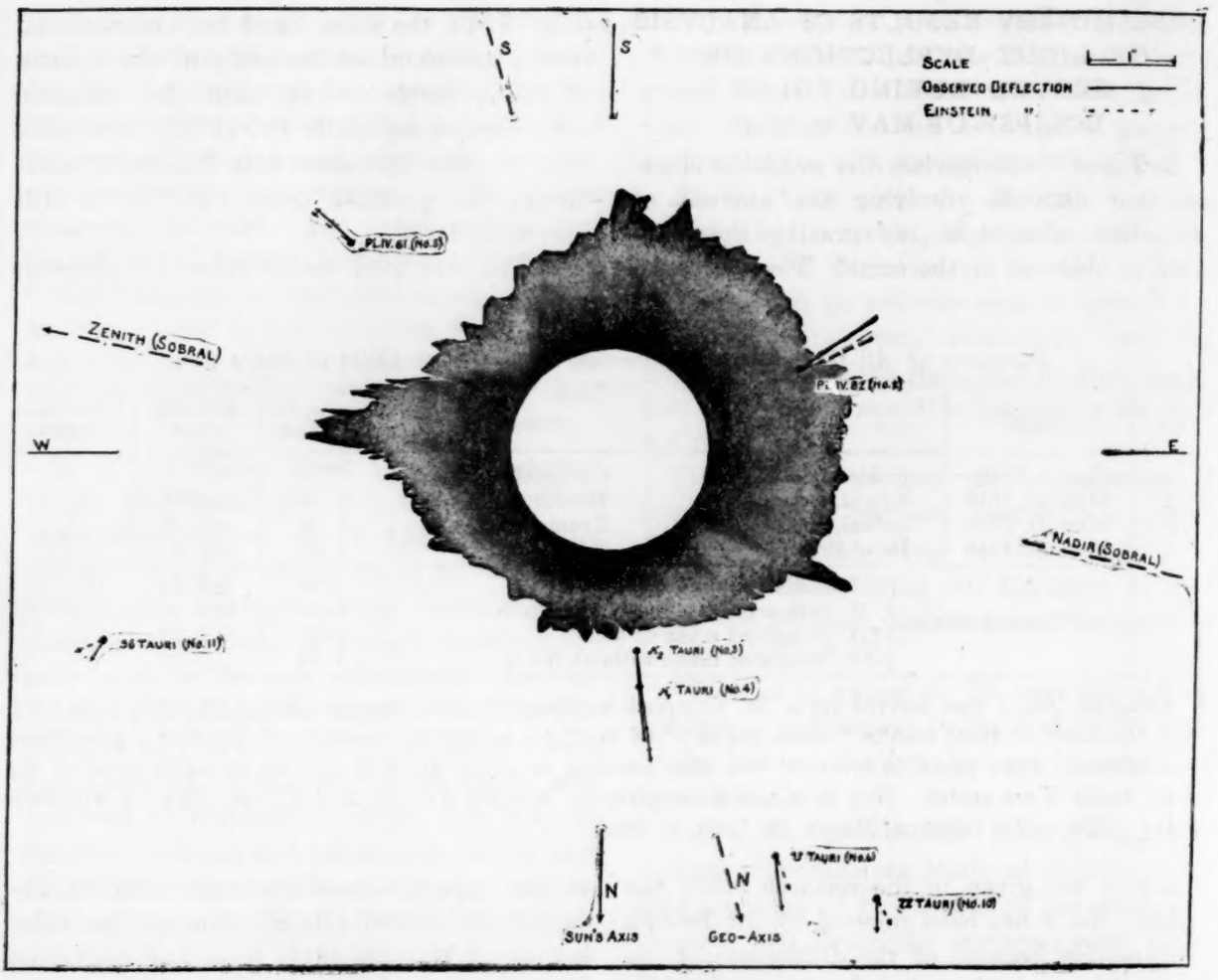

FIG. 1. Dr. Crommelin's observed light deflections at Sobral, Brazil, plotted for each star according to direction and a relative scale of magnitude.

(Full line is observed vector; broken line is the Einstein vector. It will be observed that, in general the observed vector departs from the Einstein vector in a direction *away* from a diameter of the sun passing through the zenith for Sobral as projected on the photographic plate; about this diameter, furthermore, the angular departures, or non-radical effects, are found to be symmetrical.)

expeditions of the Department of Terrestrial Magnetism during the solar eclipse of May 29, 1919, at Sobral (D. M. Wise, in charge) and at Cape Palmas, Liberia (L. A. Bauer, in charge) upon the complete interpretation of results of the astronomical observations. We also received from Dr. H. Morize, director of the Rio de Janeiro Observatory, meteorological data pertaining to his eclipse station, which was likewise Sobral, and desire to acknowledge our indebtedness to him. It may be recalled that the rays of light whose deflections were measured during the solar eclipse were subject chiefly: *a* to a gravitational action from the sun, *b* to optical refraction in the sun's atmosphere, and *c* to optical refraction in the earth's atmosphere. The bearing of the geophysical observations will be chiefly in relation to *c*.

3. Let α_0 be the gravitational deflection of a light ray grazing the sun's limb, α_r, the gravitational deflection of the ray at the distance ρ from the center of the sun expressed in units of the sun's radius; then, according to the Einstein law of gravitation, we have

$$\alpha_r = \frac{\alpha_0}{\rho} = \frac{1''.74}{\rho}.$$

The deflection by this law should everywhere be the same on a circle concentric with the sun, *i. e., condition* (*1*) the deflection should vary alone with the inverse distance, not also, for example, with heliographic latitude; furthermore, the deflection should be strictly radial, *i. e., condition* (2) the deflection should coincide in direction with a line drawn to the center of the sun. Plotting Crommelin's actually observed deflections, for each of the 7 stars, in magnitude and direction, as was done in Fig. 1 by the Department of Terrestrial Magnetism, a careful examination shows that there are systematic departures from both conditions (1) and (2) which apparently can not be explained wholly by errors of observation.[2] In addition we have the fact that the resulting value of α_0, No. 3 in Table I., is 1″.98 instead of 1″.74, or about 14 per cent. larger than the theoretical value. What was the chief cause of the superposed effects?

4. Table 2 contains our resolved components of the observed light deflections, namely, the strictly radial component, α_r, and α_p, the component perpendicular to the radius, representing the non-radial effects or angular departures, β, from radiality, exhibited in Fig. 1. A is the positon angle of the star counted continuously in the direction N, E., S., W., from the north end of the declination or geo-axis; the north end of this axis for Sobral at mid-totality was about 16°.8 east of the north end of the sun's axis of rotation. The two columns giving the probable errors, as deduced by us from the individual data derived from Crommelin's 7 plates, show that the average probable error for both the radial and non-radial components is about +0″.04. The angular departure, β, it will be observed, varies from −28° to +37°; a plus value means an angular departure in the positive direction of the angle A, *i. e.*, in the direction N., E., S., W. The sign of α_p corresponds with that of β. How many of the 7 plates gave a plus or a minus β is shown in the last two columns. It will be seen that for stars 6 and 10, the minus sign greatly predominates and for stars 2 and 11, the plus sign greatly predominates.

TABLE II

Radial and Non-Radial Components of Observed Light Deflections at Sobral, Brazil, May 29, and Angular Departures for Radiality

Based on results from 7 photographic plates obtained by Dr. A. C. D. Crommelin with a 4-inch lens of 19-foot focus and using an 8-inch cœlostat.

No.	Star	Pos. Angle	Dist.	Einstein Deflection	Observed Deflection		Probable Errors		Angular Departure		
		A	ρ		Radial	Non-Radial	Rad.	N. R.	β	+	=
3	κ_2 Tauri	351°.8	1.99	0″.88	1″.02	−0″.05	0″.02	0″.02	− 2°.9	3	4
2	Pi. IV. 82	96.0	2.04	0.85	0.97	+0.16	0.04	0.05	+ 9.6	6	1
4	κ_1 Tauri	352.0	2.35	0.75	0.84	+0.01	0.03	0.03	+ 0.8	2	5
5	Pi. IV. 61	215.6	3.27	0.53	0.54	−0.02	0.05	0.04	− 2.5	3	4
6	υ Tauri	6.3	4.34	0.40	9.56	−0.16	0.04	0.04	−16.0	1	6
10	72 Tauri	15.0	5.19	0.34	0.32	−0.17	0.05	0.04	−27.9	0	7
11	56 Tauri	273.6	5.38	0.32	0.20	+0.15	0.06	0.02	+37.2	7	0

5. Table II. shows the following facts:

(*a*) The observed radial component is greater than the Einstein theoretical value for the first five stars (Nos. 3, 2, 4, 5 and 6) and less for the two most distant stars (Nos. 10 and 11). (The observed radial deflections for the two stars, Nos. 6[3] and 11, which depart most from the Einstein values, correspond, respectively, to deflections at the sun's limb of

[2] Dr. Silberstein has also directed attention to the existence of the non-radial effects. *Monthly Notices, R. A. S.*, Vol. 80, pp. 111–112.

[3] Curiously, Eddington's observed deflection for star 6, according to data kindly supplied recently, also departs most markedly from the Einstein law; in his case, however, the deflection reduced to the sun's limb is about 55 per cent. too *low* for that star.

2″.43 and 1″.11, thus exhibiting a range of 75 per cent.)

(*b*) The observed non-radial component, which according to the Einstein law (1) should be zero, varies from −0″.17 to +0″.16; it amounts at times to one tenth of the Einstein radial deflection at the sun's limb and is from 3 to 7 times the probable error.

(*c*) The value of the deflection at the sun's limb as deduced from stars Nos. 3, 4, 6 and 10, near the sun's axis, is 2″.02, and from stars Nos. 2, 5 and 11, near the sun's equator, 1″.88; the two values differ 0″.14 or 8 per cent. (The observed deflection therefore is a function not simply of distance alone, as required by the Einstein law, but also apparently of the position angle.)

6. After various trials the following preliminary formulæ were found to represent the observed quantities with good approximation:[4]

$$\alpha_r = \frac{1''.77}{\rho} + \frac{0''.29}{\rho}\sin^2(A - 239°), \qquad (2)$$

$$\alpha_p = 0''.0323\rho \sin 2(A - 233°). \qquad (3)$$

The close agreement in the independently-derived phase angles, 239° and 233°, led to the impression that some common cause produced the superposed radial effect, represented by the second term in (2), and the non-radial effects represented by (3). Now the position angle of the zenith for Sobral at mid-totality of the eclipse, projected on the plate, is 241°.6, which value could be substituted with fair approximation in place of the phase angles for (2) and (3). Thus the second term of (2) and the single term of (3) were found to be related in some manner to the local zenith. The effect of terrestrial atmospheric refraction on the sun and the stars is to shift them apparently all towards the zenith, those farthest from the zenith being shifted most. The question accordingly arises whether the superposed effects with which we are concerned may not have resulted from incomplete elimination of differential refraction effects in the earth's atmosphere. It may be observed also that by the introduction of our second term in (2), the value of the deflection at the sun's limb was reduced from 1″.98 to 1″.77, which agrees closely with the Einstein value.

7. With the effective aid of my colleague, Mr. W. J. Peters, in charge of the reduction of the atmospheric-refraction observations made aboard the *Carnegie*, the possible outstanding effects resulting from incomplete elimination of differential refraction effects in the earth's atmosphere have been investigated. The differential terrestrial refraction effects between the sun and each of the 7 stars were rigorously computed by two different methods for the time of exposure of the eclipse plates and the prevalent meteorological conditions. Lacking complete details regarding the precise times of exposures of the check-plates obtained before sunrise between July 12 and 18, our computed differential-refraction effects for the check-plates are for the present only tentative ones. The examination as far as it can be made at present indicates that outstanding effects in the differences between the differential terrestrial refraction effects for the eclipse-plates and the check-plates, may largely, if not completely, account for the non-radial effects in the observed light deflections, as also decrease the value (1″.98) of the radial deflection at the sun's limb. This is a matter that can be more definitely determined when the original data and complete details regarding the reductions of the measures are available. *The present indications are that precise allowance for differential terrestrial refraction effects may bring Crommelin's results into closer accord with the Einstein law of gravi-*

[4] The sum of the residuals squared on the basis of formula (1) was 0.093, whereas on the basis of (2) the sum was reduced to 0.037. Were the non-radial effects regarded solely as errors of observation, then the sum of the squares amounts to 0.106; however, the sum of the squares of the residuals resulting by applying formula (3) is but 0.016. Other formulæ were also established giving a still closer representation of the observed quantities than do (2) and (3), however, they did not admit of physical interpretation as readily as those given. This matter will be discussed more fully in the complete paper.

tation. Possibly also when reductions of the photographic measures have been made with every possible refinement, some outstanding effect may be disclosed to be referred to optical refraction in the sun's atmosphere, especially for stars in the polar regions like Nos. 3, 4, 6 and 10, where the length of the light path through the solar atmosphere would be considerably less than for stars 2, 5 and 11, in the equatorial regions (*cf.* § 5*c*).

A future communication will give further consideration to this matter.

8. In the foregoing paragraph nothing has been said as to the possibility of irregularities in the differential refraction effects in the earth's atmosphere such as have been disclosed by various investigators and which may not have affected every ray alike over a star field embracing about two degrees of arc. In brief, the actual differential terrestrial refraction effects, because of atmospheric conditions during totality of the eclipse or during the times when the check-plates were exposed, or because of the manner of mounting of the instrumental appliances, may have been appreciably different from those derived from mathematical formulæ and standard refraction tables. It would seem that in future tests of the Einstein effect, atmospheric-refraction observations and allied meteorological observations should be included as a necessary part of the program of work.

L. A. BAUER

DEPARTMENT OF TERRESTRIAL MAGNETISM,
WASHINGTON, D. C.,
May 11, 1920

FOURTH YEAR OF THE NEOTROPICAL RESEARCH STATION

THE work of the New York Zoological Society Station in British Guiana began in 1916. Owing to the difficulty of transportation at the time of the war, there was a lapse during 1917, but work was resumed in 1918 and 1919. The station is now entering its fourth year. It has been directed with great ability by Mr. William Beebe, Honorary Curator of Birds at the Zoological Park, and has been supported by personal contributions of the trustees of the Zoological Society.

The distinctive research feature of this station is intensive biologic observation in one region, in fact, in one locality, as distinguished from the observations of Darwin, Bates, Waterton, Chapman, and many other explorers in the great biologic field of South America. The area chosen by Director Beebe is the eastern edge of the tropical rain-forest of South America, which extends unbroken across the greater part of the continent. The fauna and flora are uniform with those of the entire Amazonian region. The locality in Bartica District, British Guiana, at Kartabo, the point of junction of the Mazaruni and Cuyuni rivers, has proved ideal in every way as a permanent site for this station. Within ten minutes walk are sandy and rocky beaches, mangroves, grassland, swamp, and high jungle, each with a growth of life peculiar to itself. Free exposure to the trade winds, the absence of flies and mosquitos, invariably cool nights, excellent buildings assigned by the government—all these features contribute to the wide range of life and the unbroken health of the scientific staff.

This region affords a vast opportunity for studying the faunal and floral complex, independent and interrelated adaptations in all grades of life in vertical as well as horizontal life zones. The vertical division of the fauna and flora in distinctive zones, extending from the tree summits to the subsoil, is a biologic contribution of importance. The observations of the station extend from color changes and adaptations to anatomical and functional characters of the archaic as well as of the highly modernized forms of life.

All together seventy-five papers have been published on the scientific observations of this station, parts of which have already been reviewed in the volume "Tropical Wild Life" issued by the society in 1917. Three papers appeared in the first volume of *Zoologica* (1907–1915), and it has been decided to reserve the third volume of *Zoologica* exclusively to scientific papers on the station.

During the year 1919 Director Beebe's

work dealt chiefly with environmental problems and evanescent characters such as color, pattern, tissue form, developmental change and habits of the higher vertebrates. Elaborate studies were made of the eyes of reptiles and amphibians, also of the tongue, tarsus, and hyoid apparatus of three families of birds, the Formicariidæ, Cotingidæ, and Tyrannidæ, and the syringes of one hundred and twenty-two species of birds. The general notes on life histories of amphibians, reptiles, and birds were greatly increased and will shortly be ready for publication. Among the lower forms, six specimens of *Peripatus* were studied, one of which gave birth to eight young.

Without in any way interfering with the scientific work of the station it was found possible to collect and preserve for the American Museum a collection of two hundred and seven mammals, skins, skulls and skeletons, with full data, comprising about forty-three species. Among these was a series of thirteen red howling monkeys of various ages, part of which has been introduced in one of the groups in the Primates Hall of the American Museum. Every reptile and amphibian, excepting those involved in research problems, was preserved, a collection of two hundred being brought north to the American Museum. To aid current research on the Crocodilia, a series of crocodile skulls was sent north. Similarly a number of large electric eels was collected for Professor Ulric Dahlgren, of Princeton, and embryos of the red howling monkey were sent to Dr. Adolph H. Schultz, of Johns Hopkins University.

Mr. John Tee-Van, of the New York Zoological Park, in addition to the economic administration of the station, made five hundred pen and ink drawings of the syringes and tongues of birds, considered to be of great importance in classification. Mr. Alfred Emerson, of Cornell University, chose the Termites as his object of research and completed his biologic studies on fifty-six species. Professor Albert M. Reese, of the University of West Virginia, began a microscopic study of the swamp and river fauna, and an intensive environmental investigation of a hundred yards of sandy beach in front of the laboratory. His chief research was on the embryology of the crocodile, obtaining embryos of all stages. Mr. Clifford Pope, of the University of Virginia, worked on the fish life near the station and obtained valuable data on thirty-five species. Miss Isabel Cooper, of Bryn Mawr, made two hundred and forty-five paintings and drawings, in full color, of fishes, amphibians, reptiles, and invertebrates, most of them known heretofore only from colorless alcoholic specimens. Among the most interesting paintings are those of the living eye of amphibians and reptiles.

In the year 1919 the station was open from March first until October. Director Beebe and six associates and assistants are leaving New York May 8, 1920, for the fourth season's work.

Season of 1920

The party leaving New York on May 8 for the fourth season includes William Beebe, director; John Tee-Van, scientific assistant and preparator; George Inness Hartley and Alfred Emerson, research associates; Clifford Pope, research assistant; Isabel Cooper and Anna Taylor, artists.

In addition to the continuation of the regular research work of the station of previous years, as outlined in the above report, there will be special studies on the habits of the hoactzins and the army ants, with the new Akeley moving picture camera. Attempts will be made to secure living giant armadillos and hoactizins for the Zoological Park of New York.

Professor Ulric Dahlgren, of Princeton, will visit the Neotropical Station in August to begin his researches on the electric eel *Gymnotus*. Professor William Morton Wheeler, of the Bussey Institution, with his son Mr. Ralph Wheeler, accompanied by Professor J. C. Bailey, will visit the station in July to study the ant fauna. Dr. Casey Wood, one of the leading authorities on the fundus oculi of the sauropsids and amphibians, expects to visit the station later in the year accompanied

by Dr. Harold Gifford. Four artists will be at the station during the present year and will devote especial attention to recording the coloring of creatures too delicate to bear transportation alive to a temperate zone.

Among the incidental results of the work of the station is a rich and continuous supply of living animals to the New York Zoological Park, including such animals as the jaguar, ocelot, capybara, agouti, anaconda, and jabiru. This season a very much larger collection of living animals will be made and sent north.

HENRY FAIRFIELD OSBORN
PRESIDENT OF THE NEW YORK ZOOLOGICAL SOCIETY,
May 6, 1920

SCIENTIFIC EVENTS

COLLECTIONS OF THE NATIONAL MUSEUM

THE annual report of the director of the U. S. National Museum states that the total number of specimens acquired by the museum during the year was approximately 526,845. Received in 1,198 separate accessions, they were classified and assigned as follows: Department of anthropology, 12,333; zoology, 442,383; botany, 40,357; geology and mineralogy, 4,750; paleontology, 26,050; textiles, woods, medicines, foods, and other miscellaneous animal and vegetable products, 884; mineral technology, 62; and National Gallery of Art, 26. As loans for exhibition, 3,096 articles were also obtained, mainly for the divisions of history and American archeology and the Gallery of Art.

Material to the extent of 539 lots was received for special examination and report.

The distribution of duplicates, mainly to schools and colleges for educational purposes, aggregated 3,441 specimens, of which 1,378 were contained in seven regular sets of fossil invertebrates averaging 47 specimens each and six regular sets of mollusks of 174 specimens each. The balance comprised 19 special lots, consisting of marine invertebrates, reptiles, fishes, fossils, minerals and ores, stone implements, and basketry specimens.

In making exchanges for additions to the collections, a total of 5,227 duplicate specimens were distributed. These consisted largely of plants.

Material sent out to specialists for study on behalf of the Museum amounted to 19,851 specimens, mainly biological.

In furtherance of its extensive historical exhibits, the Museum, early in the year, through cooperation with the War and Navy Departments, undertook the assembling and installation of a collection of materials connected with the World War, which may ultimately, require a separate building.

APPROPRIATIONS FROM THE HENRY DRAPER FUND OF THE NATIONAL ACADEMY OF SCIENCES

AT its recent meeting the National Academy of Sciences made the following appropriations on the recommendation of the committee on the Henry Draper Fund:

$400 to S. A. Mitchell, of the University of Virginia, to complete the purchase of a measuring microscope for use in the photographic determination of stellar parallaxes, on the basis of observations made with the 27-inch refracting telescope. The academy awarded the sum of $250 from the Draper Fund to apply on the purchase of this instrument and the proposed grant of $400 will complete the purchase. The microscope, costing $650, becomes in effect the property of the academy. Professor Mitchell will devote an equivalent sum, $400, to other needs of his parallax research.

$300 to Joel Stebbins, professor of astronomy in the University of Illinois, to assist in the further development of the photo-electric-cell photometer.

$400 to Frank Schlesinger, director of the Allegheny Observatory, to enable him to test an automatic zenith camera for the determination of terrestrial latitude, with the expectation that the results will be more accurate than any hitherto obtained by other means. It is proposed that this instrument be mounted temporarily at the International Latitude Observatory at Ukiah, California, where the astronomer in charge will operate it for a year or two as a labor of love. The grant is needed to install the instrument at Ukiah and to make certain auxiliary apparatus required in its operation. The Allegheny Observatory is loaning the objective and the photographic plates obtained will be measured by Dr. Schlesinger himself or under his immediate direction.

$175 to E. B. Frost, director of Yerkes Observatory, for the purchase of a Hess-Ives tint photometer for use in the Yerkes Observatory, to supplement the Hartmann micrometer in the measurement of various illuminants, of the transmission of filters for various wave-lengths, of the absorption of photometric gratings, and of other phenomena and subjects.

$500 to Dr. Antonio Abetti, director of the Arcetri Observatory, Florence, Italy, to apply on the cost of a combined spectrograph and spectroheliograph for use in combination with a 60-foot tower telescope now under construction. It is planned that this instrument shall be used by the son of the director, Dr. Giorgio Abetti, well known to many American astronomers, recently transferred from the Observatory in Rome to the Arcetri Observatory.

$200 to Major William Bowie, chief of the Division of Geodesy, U. S. Coast and Geodetic Survey, in temporary support of the International Latitude Observatory at Ukiah, California, to assist in meeting an emergency due to the failure of the Observatory's regular source of funds.

ASSOCIATION OF SCIENTIFIC APPARATUS MAKERS OF THE UNITED STATES OF AMERICA

The second annual meeting of the Association of Scientific Apparatus Makers of the United States as reported in the *Journal of Industrial and Engineering Chemistry,* was held at Washington, D. C., Thursday and Friday, April 22 and 23, 1920, and was attended by thirty of the leading manufacturers of scientific instruments, analytical balances, chemical glassware, optical instruments and pyrometers.

The purpose of this association is to improve the construction and design of the scientific apparatus of this country and to standardize the same so as to get uniform quality and sizes; also, the most important object is to build up in the United States a precision instrument industry that will be of aid to the national government in time of emergency. Prior to 1914, practically all instruments of precision were imported and when our government declared war in 1917, it was found that there were not enough instrument makers and manufacturers to provide adequate supplies of precision instruments for the laboratory control of essential factories and to build fire control instruments for the Army and Navy. The association is now working to perpetuate this industry and to make the nation independent of any foreign country. In carrying out their program they are working in conjunction with the National Research Council, the American Chemical Society, Bureau of Standards and the various scientific bureaus of the National government.

One of the most important addresses of the occasion was given by Dr. S. W. Stratton, director of the Bureau of Standards, in which he set forth the various activities of the Bureau and stated how it would be possible to cooperate with this association. On Friday afternoon, at the invitation of Dr. Stratton, the association was shown through the various departments of the Bureau of Standards.

Committees were appointed on standardization in the various departments to work in conjunction with the above-mentioned agencies and also, if possible to correlate their work with the committee of the Society of Chemical Industry of Great Britain, which is working along similar lines. There was also a committee appointed on publication which will report later. The officers for the coming year are as follows: *President,* M. E. Leeds, of the Leeds & Northrup Company; *Vice-president,* H. N. Ott, of the Spencer Lens Company; *Secretary-treasurer,* J. M. Roberts, of the Central Scientific Company.

THE GRADUATE SCHOOL OF MEDICINE OF THE UNIVERSITY OF PENNSYLVANIA

At the last meeting of the board of trustees steps were taken to further equip and advance the work of the university's graduate school of medicine. A budget of $158,079.37 was approved to meet such expenses as are not provided in the regular income of the school. Provost Smith appointed John C. Bell chairman of the joint committee on the graduate school of medicine.

A committee from the graduate school, consisting of Dean George H. Meeker, Dr. George E. de Schweinitz, Dr. Alfred Stengel and Dr. P. S. Stout, attended the meeting and ex-

plained the new plans of the school. What these men said concerning the work of the school is now doing and its recognition throughout the medical world greatly impressed the trustees. The following resolutions concerning the school were unanimously adopted:

Resolved, That in the judgment of the board of trustees the maintenance and development of the graduate school of medicine is essential alike to the cause of medical education in this commonwealth and to the leadership of the university in this field.

Resolved, That the budget of the graduate school of medicine for the year 1920–21, involving an estimated deficit of $158,079.37, be approved.

Resolved, That a committee consisting of all the members of this board and such others as may be appointed by the provost be empowered to cooperate with the managers of the hospitals of the graduate school of medicine in raising the necessary funds for the support of that school.

Resolved, That pending the receipt of the necessary contributions for the support of the graduate school of medicine the credit of the university be pledged and the treasurer be authorized to pay out of unrestricted funds not otherwise appropriated such sums as may be necessary, not exceeding the amount of the estimated deficit, $157,079.37.

OFFICERS OF THE NATIONAL RESEARCH COUNCIL

THE National Research Council has elected the following officers for the year beginning July 1, 1920: Chairman, H. A. Bumstead, professor of physics and director of the Sloane physical laboratory, Yale University; First Vice-Chairman, C. D. Walcott, president of the National Academy of Sciences and Secretary of the Smithsonian Institution; Second Vice-Chairman, Gano Dunn, president of the J. G. White Engineering Corporation, New York; Third Vice-Chairman, R. A. Millikan, professor of physics, University of Chicago; Permanent Secretary, Vernon Kellogg, professor of entomology, Stanford University; Treasurer, F. L. Ransome, treasurer of the National Academy of Sciences. The chairman of the various Divisions of the Council have not yet been all selected but will be announced later. As the general officers and the division chairmen of the council are elected annually, with the consequent possibility of an almost complete change of administrative officers at the end of any annual period, the council instituted the office of permanent secretary for the sake of effecting some degree of administrative continuity. Professor Kellogg, who has for the past year been serving as secretary of the council and chairman of its division of educational relations, will fill this office, and will resign from Stanford University on July 1 of this year.

SCIENTIFIC NOTES AND NEWS

ON the recommendation of the National Academy of Sciences the Barnard medal for meritorious service to science has been conferred by Columbia University on Professor Albert Einstein, of Berlin, in recognition "of his highly original and fruitful development of the fundamental concepts of physics through application of mathematics."

DR. ERNEST SOLVAY, Belgium, has been elected to honorary membership in the American Chemical Society.

THE honorary degree of doctor of science was conferred on Edward William Nelson, chief of the U. S. Biological Survey, at the recent commencement exercises of George Washington University.

ON the evening of May 22, a dinner was given at New Haven to Professor Russell H. Chittenden in honor of the fortieth anniversary of his receiving the degree of doctor of philosophy from Yale University. Sixty-five former graduate students and friends were present. The dinner followed the one hundred and eighth meeting of the Society for Experimental Biology and Medicine.

DR. EDGAR FAHS SMITH, retiring provost of the University of Pennsylvania, was a guest of honor at a dinner given by nearly 500 members of the faculty of the University of Pennsylvania at Weightman Hall, May 26.

DR. SIMON FLEXNER, of the Rockefeller Institute for Medical Research, has been appointed to represent the United States at the first formal meeting of the Medical Advisory

Board of the League of Red Cross Societies that will open at Geneva on July 5. The representatives of other nations at the conference will be Professor Brodet, Belgium; Professor Madsen, Denmark; Professors Roux, Albert and Calmette, France; General Lyle Cummins, Sir Walter Fletcher and Sir George Newman, Great Britain; Professor Bastianello and Dr. Castellani, Italy; Dr. Kinnostke Miura, Japan, and Dr. Chagas, South America.

Dr. George B. Frankforter, who has been during the war examiner of explosives, chemicals and loading in the Ordnance Claims Board and later technical adviser to the board, has returned to the University of Minnesota as professor of organic and industrial organic chemistry.

Dr. Austin H. Clark, assistant curator in the division of marine invertebrates of the Nation Museum, has been appointed curator of the division of echinoderms.

Dr. Frank E. Lutz, of the American Museum of Natural History, is in Wyoming continuing the museum's work on the ecological distribution of western insects.

The California Academy of Sciences has granted temporary leave of absence to Dr. G. Dallas Hanna, curator of invertebrate paleontology to enable him to comply with a request from the United States Bureau of Fisheries to take the annual census of fur seals on the Pribilof Islands, Alaska in 1920. Departure will be taken from Seattle about June first on the U. S. S. *Saturn*. Dr. Hanna was formerly attached to the staff of the Bureau and besides being associated with the census work since 1913 has made large collections of natural history material. It is expected these will be considerably augmented during the coming summer.

Dr. L. E. Griffin, professor of zoology at the University of Pittsburgh, formerly professor of zoology and dean of the arts college in the University of the Philippines, lectured before the West Virginia Scientific Society on May 27 upon "The Development of Science in the Philippines."

Dr. Carl O. Johns, of the Color Investigation Laboratory, Washington, D. C., recently lectured before the graduate students in chemistry of Yale University on "The application of organic chemistry in government work."

M. Pierre Janet, professor of psychology in the Collège de France gave recently three lectures at the University of London on "La tension psychologique, ses degrés et ses oscillations."

Clarence Ehnie Broeker, who, in collaboration with Dr. W. D. Harkins at the University of Chicago, according to their preliminary results, had successfully fractionated hydrogen chloride into what appear to be acids of isotopic forms of chlorine (Science, LI., 289, 1920), died on May 9, after a brief illness. In recognition of his skillful work and ability Mr. Broeker had been appointed to the Swift fellowship in chemistry, the highest honor in the gift of the chemistry department of the University of Chicago.

The Civil Service Commission announces examinations on July 6, for the positions of radio engineer (aeronautics) at $3,600 to $5,000 a year and of assistant radio engineer (aeronautics) at $2,500 to $3,600 a year. On July 15 an examination is announced for a position in metallurgical engineering at the Naval Ordnance Plant, South Charleston, W. Va., at $5,000 a year.

Dr. Benjamin White has been appointed director of the division of biologic laboratories of the Massachusetts State Department of Public Health to succeed Dr. Milton J. Rosenau, resigned. Dr. White has also been appointed lecturer on immunology in the Massachusetts College of Pharmacy and assistant in the department of preventive medicine and hygiene of the Harvard Medical School.

Mr. A. M. Muckenfuss, professor of organic and industrial chemistry and director of that subdepartment, Emory University, Atlanta, Ga., has resigned to accept the position of research chemist with the Roessler & Hasslacher Chemical Co., Perth Amboy, N. J.

DR. CYRIL S. TAYLOR has resigned from the Bureau of Standards to accept a position in the research bureau of the Aluminum Company of America at New Kensington, Pennsylvania.

DR. JOHN S. BOYCE has been placed in charge of a branch of the office of Forest Pathology of the Bureau of Plant Industry, cooperating with District 6 of the Forest Service, which has been established at Portland, Oregon.

THE California Fruit Growers Exchange, an organization of 10,000 growers of citrus fruits, has established a research laboratory in Corona, California, in charge of Mr. C. P. Wilson, who was for thirteen years with the Bureau of Chemistry of the U. S. Department of Agriculture.

AT the annual meeting of the Boston Society of Natural History, the following officers were elected: *President,* W. Cameron Forbes; *Vice-presidents,* Nathaniel T. Kidder, William F. Whitney, Theodore Lyman; *Secretary,* Glover M. Allen; *Treasurer,* William A. Jeffries, *Councillors for eight years,* Thomas Barbour, Henry B. Bigelow, Gorham Brooks, S. Prescott Fay, Robert T. Jackson, John L. Saltonstall, John E. Thayer, Charles W. Townsend. The following were elected honorary members of the society: G. A. Boulenger, Sidney F. Harmer, Aubrey Strahan, of London; Emmanuel de Margerie, of Paris; John Macoun, of Ottawa; Elmer D. Merrill, of Manila.

MR. GERARD FOWKE, a collaborator of the Bureau of American Ethnology, left St. Louis on April 1 for Honolulu. He will make an archeological reconnaissance of the Hawaiian Islands with a view to future intensive work by the bureau.

THE tenth annual summer field course in geology of the University of Missouri will be conducted by Professor E. B. Branson and Mr. R. B. Rutledge during July and August. About one week will be spent in the Black Hills and the rest of the time in the Big Horn Mountains of Wyoming. The party will be limited to sixteen students. Messrs. Branson and Rutledge, who are now on leave of absence from the University of Missouri engaged in geological investigations in Costa Rica, will return to the United States late in June.

AT a recent meeting of the Iota (Kansas) Chapter of the Society of Sigma Xi a resolution of commendation and congratulation was ordered to be transmitted, over the signatures of the president and secretary of the society, to Dr. Solomon Lefschetz for his memoir entitled "Sur Certains Nombres Invariants des Variétés Algébriques avec Application aux Variétés Abéliennes," for which the Bordin prize of 3,000 francs was awarded in 1919. The following is the resolution: "The Iota Chapter of the Society of Sigma Xi (University of Kansas) congratulates Dr. Solomon Lefschetz on the receipt of the Bordin Prize of the Paris Academy of Sciences as an appropriate acknowledgment of his mathematical ability and productive scholarship. It furthermore commends Dr. Lefschetz in the highest terms for his indefatigable industry in scientific research, and will await with interest his future contributions to mathematical science."

AT the annual general meeting of the Royal Astronomical Society on February 13, the president, Professor A. Fowler, gave an address on the foundation of the society just a century before. According to an abstract in *Nature* he said that the four men who were most influential in its formation were the Reverend William Pearson, Mr. Francis Baily, Sir John F. Herschel and Mr. Charles Babbage. The two latter both lived until 1871, and there are no fewer than fifteen surviving fellows whose fellowships overlapped with theirs. One of these, Mr. Inwards, said that he remembered speaking to Sir John Herschel at a meeting of the society. There was at first a good deal of opposition to the new society on the part of the Royal Society, and the Duke of Somerset, who was elected the first president, quickly resigned this office owing to the pressure brought to bear upon him. He was succeeded after an interval by Sir William Herschel, who was then eighty-two years of age, and died in 1822. Mr. Stephen Groombridge, well known for his

Star Catalogue, was another of the original members. They were not called fellows until 1830, when the royal charter was granted, giving the society its present title; it was previously called the London Astronomical Society. The earliest publications of the society were in the form of memoirs; the Monthly Notices did not commence until several years later, and were at first only small pamphlets containing ephemerides of comets and other matters of transient interest.

The British Medical Journal writes:

Owing to the war the zoological station at Naples has suffered in many ways, and it is highly necessary that this very important international scientific institution should receive the support necessary to enable it to carry on its work without restriction. But, although its importance for zoological and morphological research has always been recognized, its advantages for physiological and biochemical studies are by no means as widely known as they ought to be. The station is fully equipped with all necessary apparatus and materials, and the section for physiology and biochemistry, being under the very capable direction of Professor Bottazzi, the professor of physiology in the University of Naples, students are assured not only of the opportunities of carrying out independent and untrammelled research, but of the best advice and direction from the staff. There is an admirable library, with very complete sets of periodical publications. The rent of a table is 2,500 francs a year (payable in gold), and the director of the station will furnish all details to students who propose to carry out any research there. The study of comparative physiology has bearings upon immunology, upon the question of functional activities, upon biochemistry and physiology in general, the importance of which in their relation to medicine needs no emphasis. The effect on international relations of a free use of these scientific facilities being made by British students and of their intercourse with Italian men of science is but little less important.

The American Fisheries Society will hold its fiftieth anniversary meeting at Ottawa, Canada, on September 20, 21 and 22, 1920. For this meeting the society will offer prizes of $100 for papers in competition in each of the following classes. (1) For the contribution showing the greatest advance in practical fish cultural work; (2) For the best contribution to biological work connected with fish problems in general; (3) For that which offers the greatest promise of the solution of problems affecting commercial fisheries work. The papers should be in the hands of the secretary not later than August 20. Further information can be obtained from the executive secretary, Professor Raymond C. Osburn, Ohio State University, Columbus, Ohio.

UNIVERSITY AND EDUCATIONAL NEWS

Yale University has received $1,000,000 from the General Education Board for the development of the New Haven General Hospital through the medical school of the university. The hospital will be made a full-time institution, the staff many of whom are members of the Yale Medical School faculty, giving all their time to the hospital and foregoing outside practise. When the Yale Medical School became affiliated with the New Haven hospital a few years ago, a gift of $500,000 from the General Education Board was received.

The General Education Board has made a gift of $500,000 each to the endowment funds of Smith College and Mount Holyoke College and $400,000 to that of Wesleyan University. It has also made an appropriation of $250,000 to Middlebury College on condition that an additional $750,000 be raised by subscription.

Mr. Edward Whitley has offered to Oxford University the sum of £10,000 towards the endowment of a professorship of biochemistry, and the British Dye-Stuffs Corporation has made a donation of £5,000 towards the cost of extending the laboratory of organic chemistry.

The Convocation of Oxford University has passed without opposition the statute providing for the matriculation and admission of

women for degrees in the university. The Cambridge University Syndicate appointed to consider the question is divided in opinion; half have reported in favor of admission to full membership, and half in favor of a separate university at Cambridge.

DR. DAVID KINLEY, professor of economics and dean of the graduate school of the University of Illinois, has been elected president to succeed Dr. Edmund Janes James.

DR. LAUDER W. JONES, dean of the School of Chemistry and also of the College of Engineering and Architecture of the University of Minnesota, has accepted an appointment as professor of organic chemistry at Princeton University.

ALICE M. BORING, of the Peking Union Medical College, China, has been appointed assistant professor of zoology at Wellesley College, beginning with the academic year 1920–21.

DR. ELLSWORTH D. ELSTON, of Cornell University, has been appointed assistant professor of geology at Dartmouth College.

ASSOCIATE PROFESSOR J. WEMYSS ANDERSON, has been appointed to the recently established John William Hughes Chair of Engineering Refrigeration at Liverpool University.

DISCUSSION AND CORRESPONDENCE

MODERN INTERPRETATION OF DIFFERENTIALS AGAIN

TO THE EDITOR OF SCIENCE: I regret that in my criticism (SCIENCE, March 26) of Professor Hathaway's exposition of differentials (SCIENCE, February 13) I was led by an unwise desire for brevity into making a statement which, in its unqualified form, will not stand analysis. The statement that "lim $N\Delta y$ is inevitably zero" is certainly not true unless N remains finite, and Professor Hathaway is quite justified (SCIENCE, May 7) in chiding me for this error, since his N is not restricted to finite values.

At the same time I can not feel that I was essentially mistaken in contending that his presentation of differentials "would prove highly misleading to the modern student."

It is true that when he defines the differential dy as the limit of $N\Delta y$ for lim $\Delta y = 0$, he does allow the multiplier N to vary (as I should have stated); but it is also true that *he gives no indication whatever as to the manner in which N is to vary; and without some such indication his limit of $N\Delta y$, and hence his differential, dy, remain wholly undefined!*

On page 167 (I quote verbatim this time, to avoid the danger of renewed injustice), his formal interpretation of differentials is given as follows: they are "ordinary arithmetical increments, but in a variation defined as *in the first ratio,* or *as the variables begin to increase,* or, *in the instantaneous state,* which are all one."

I maintain that such vague statements are not likely to convey to any student's mind "a rigorous theory, neglecting no quantity, however small, leaving no unexplained symbol." They are much more likely to leave him with the traditional impression that differentials are really as Bishop Berkeley called them, the "ghosts of departed quantities," or, in Professor Osgood's phrase, abominable "little zeroes," unworthy of a place in mathematical discussion.

The object of my brief letter was, as stated, not to discuss historical questions (the importance and value of which no one can deny) but merely to contrast the obscurity of Professor Hathaway's presentation with the clearness and simplicity of the modern treatment—the treatment which has been the commonplace of every treatise of recognized standing since the middle of the nineteenth century.

EDWARD V. HUNTINGTON
HARVARD UNIVERSITY

POPULAR SCIENTIFIC LITERATURE

TO THE EDITOR OF SCIENCE: In the issues of SCIENCE for February 20 and 27 Mr. F. L. Ransome, of the U. S. Geological Survey, published a most interesting article on the "Functions and Ideals of a National Geological Survey."

In this article, attention was given to the

educational work which such a survey might carry on. To a librarian, his statements are of more than casual interest. He called attention to the dearth of popular literature on certain scientific subjects, especially geology. While other branches of nature study, including plant and animal life, appeal to a wider circle, and have been considered in a large number of interesting and attractive books, the same is not true of geology or of some of the smaller forms of animal life, as, for example, insect and fresh water life.

May I venture to call the attention of some scientists who read your journal to the desirability of some small, well-illustrated and attractively written books on geology, both descriptive and historical; on some of the mineral products, such as iron and steel; on pond life; on microscopy; and on the lives of American scientists and scientific explorers.

A book is now in preparation for publication by Scribner's, "The strange adventures of a pebble." From the announcement, this is doubtless the sort of book which has been needed for some time. In the quarterly booklist of the Pratt Institute Library (which library has made a speciality of literature in this field) for January, there is a carefully selected "List of technical and scientific books for boys." Astronomy is pretty well covered. A fairly good boys' book on chemistry was published in 1918. The two titles on geology are those by Heilprin and Shaler, both rather old; and on physics, nothing better than a reprinted edition of Hopkins, "Experimental science," which could very well be entirely revised or even broken up into two less expensive volumes. Certainly there is need for more books of this sort.

In the same line, may I call attention to the need of having books lists, to be distributed through schools and libraries and printed in an attractive style with an illustrated cover, and giving descriptions of the books? The attention of many young people could be called to science as a life career if means like these were adopted. Another device to this same end would be a series of posters or printed reproductions of exhibits, showing some of the interesting phases of nature study or science. These could be printed by such a central bureau or by some national scientific society and distributed to be shown in schools and libraries and at Boy Scout and Camp Fire Girls headquarters.

Joseph L. Wheeler
The Youngstown Public Library

RULES OF THE INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

In reference to the applications made to the International Commission on Zoological Nomenclature for copies of the rules, the secretary desires to state that the commission has no supply of reprints for distribution. Several years ago, at request of the secretary, Mr. John Smallwood, 524 Tenth St., N. W., Washington, D. C., prepared several hundred mimeographed copies and he still has about 100 on hand. These are sold at a nominal price to cover expense of mimeographing and postage and zoologists desiring copies can obtain them, as long as the supply lasts, by applying directly to Mr. Smallwood.

C. W. Stiles,
Secretary

SPECIAL ARTICLES

ECHINODERMS IN BIRDS' STOMACHS

Through the courtesy of Mr. E. W. Nelson, chief of the Bureau of Biological Survey, Washington, four vials containing echinoderms taken from birds' stomachs have been sent to me for examination. As I think there are no published records of birds' using echinoderms for food, Mr. Nelson has kindly consented to my stating in Science the facts revealed by this trivial investigation and certain important inferences which may be made.

Two of the vials contained holothurian-like objects taken from the stomachs of gulls. The appearance and condition of these specimens indicate that they were picked up on the beach dead and more or less damaged. As they are now quite decalcified, they are hopelessly unidentifiable, and it is probable that one at least is not a holothurian.

The contents of the other two vials are of much greater interest. In each case, the material was taken from the stomach of a duck collected at Bayou Labatre, Alabama. One vial contains two small brown holothurians, somewhat damaged but with the calcareous particles in the skin not at all corroded or injured in any way. The condition of these specimens leaves no doubt in my mind that they were swallowed alive by the duck and that they had been in the stomach of the bird but a short time when the duck was taken. These holothurians are unquestionably some species of *Thyone,* and are very near, if not identical with, *Thyone scabra* Verrill, of the southern New England coast But *Thyone scabra* is not known from south of Delaware or from water less than ten fathoms deep. No holothurians of any sort are recorded from the Alabama coast. This duck's stomach therefore reveals the interesting fact that a species of *Thyone,* possibly *scabra* but probably distinct, lives in shallow water on the Alabama coast and serves as a part of the diet for bottom-feeding ducks.

The contents of the fourth vial confirms this conclusion and reveals further the notable fact that brittle-stars also serve as food for ducks. The material in this case is in very bad condition and is more or less digested, but the calcareous particles in the fragments of a holothurian indicate it is the same *Thyone* as in the other vial, though it has quite lost its pigmentation. Besides these *Thyone* fragments there are numerous arm-plates of a brittle-star. These are however, beyond identification and one can not even guess the genus, which they represent. The brittle-star was however an individual of moderate size and was certainly not the small and well-nigh ubiquitous *Amphipholis squamata.* No brittle-star is as yet recorded from the Alabama coast. It is to be hoped that the publication of the results of the collecting done by these two ducks may lead to equally effective efforts by some zoologist on the Gulf Coast.

HUBERT LYMAN CLARK

MUSEUM OF COMPARATIVE ZOOLOGY,
CAMBRIDGE, MASS.,

THE AMERICAN PHILOSOPHICAL SOCIETY. II

Morning Session—10 o'clock

ARTHUR A. NOYES, Sc.D., LL.D., Vice-president, in the chair

The components and colloidal behavior of protoplasm: D. T. MACDOUGAL, Ph.D., LL.D., director of the Desert Laboratory, Carnegie Institution, Tucson, Arizona, and H. A. SPOEHR. The living matter of plants is composed chiefly of mucilages and albuminous compounds in varying proportions mixed in the form of an emulsion or as a jelly. The molecules of solid matter are aggregated into groups which also include a number of molecules of water. Growth consists of the absorption of additional water to these groups, with more solid material being added at the same time, the process being termed hydration. The resultant increase may be detected by determination of increased dry weight, or measured as increase in length, thickness or volume. More exact studies in growth have become possible by the establishment of the fact that mixtures of 25 to 50 per cent. mucilage and 50 to 75 per cent. albumin show the hydration reactions of cell-masses of plants. It is also found that certain amino-compounds, such as histidine, glycocoll, alanin, and phenyl-alanin which are known to promote growth also increase the hydration of the *biocolloids* as the above mixtures are called. Following these empirical tests which have defined the character and field of research upon growth, measurements are now being made of the action of various ions or substances upon the components of protoplasm. Thus the strong metallic bases, potassium, sodium and lithium, exert a limiting action on hydration of carbohydrate (agar) in hundredth normal solution according to their position in the electromotive series, potassium being the strongest and reducing swelling most. Rubidium, however, did not take its place at the head of the list in the single series of tests made, for reasons we are not able to describe. At dilute concentrations (0.000, 1N) all these bases promote hydration, an effect also produced by amino-compounds. The inclusion of substances in a liquefied colloid, afterwards dried, produces a hydration effect different from that which results from placing the substance in the water in which the biocolloid may be placed. This fact has wide significance in the physiological action of cell-masses. Renewal or replacement of hydrating solutions may result in pulsations or rapid swellings followed by slow shrinkages or retractions. Gels similar to those entering into living matter may take on structure by which small masses or sections may display

highly differentiated action, increases in size and changes in forms after a manner which presents important possibilities in the behavior of cell-organs.

Respiration: W. J. V. Osterhout, professor of botany, Harvard University. A simple method of measuring respiration has been developed whereby determinations can be made at frequent intervals (as often as once every three minutes). The application of this method to the study of anesthesia shows the incorrectness of the theory of Verworn, according to which anesthesia is a kind of asphyxia, due to the inhibition of respiration by the anesthetic. In the study of antagonism it is found that the antagonistic substances may increase or decrease respiration, but when properly combined they show little or no interference with normal respiration. The study of the action of acids and alkalies shows that these substances may increase or decrease respiration and that the effect varies greatly with different organisms.

The behavior of the sulfurea character in crosses with Œnothera biennis and with Œnothera franciscana: Bradley M. Davis, professor of botany, University of Michigan.

Œnothera funifolia, a peculiar new mutant from Œnothera lamarckiana.

A third duplication of generic factors in Shepherd's purse: George H. Shull, Ph.D., professor of botany and genetics, Princeton University. In the third generation of a cross between a wild biotype of the common shepherd's-purse (*Bursa bursa-pastoris*) from Wales and Heeger's shepherd's-purse (*B. Heegeri*) there appeared a small number of plants of unique type, having a more coriaceous texture than in the plants of either of the two original strains involved in the cross. This new type has been designated *coriacea*. It differs from the common form, not only in texture, but the lobing of the leaf is reduced and simplified and the angles of the lobes are almost spinescent. The proportion of *coriacea* to the typical sibs in this F_3 family was 12:187 or almost exactly a 1:15 ratio. This suggested at once the presence of two independently inherited factors for the normal texture, the *coriacea* type being produced only when these two factors *K* and *L* were absent. Subsequent breeding has shown that *coriacea* breeds true when selfed, and has also confirmed the interpretation of this as a third case of duplication of factors in this species. The two characters previously shown to be thus constituted are the triangular form of capsule, and the division of the leaf to the midrib which brings to light the characteristic lobing found in the form designated *rhomboidea*. The duplication of the capsule determiners is practically universal while that of the leaf-lobe factor is less frequently found. Studies on the *coriacea* character are still too limited in extent to justify a statement as to the prevalence of duplication of the factor for the usual texture of the leaves.

Some effects of double fertilization in maize: Edward M. East, Ph.D., professor of experimental plant morphology, Harvard University.

The chemistry of the cell: Thomas B. Osborne, Ph.D., Sc.D., research chemist, Connecticut Agricultural Experiment Station. (Introduced by Dr. Harry F. Keller.)

The relation of oxygen to charcoal: George A. Hulett, Ph.D., professor of physical chemistry, Princeton University.

Products of detonation of TNT: Charles E. Munroe, Ph.D., LL.D., professor of chemistry, George Washington University, and S. P. Howell. TNT has not only proved a most efficient explosive for war purposes but, following the advice of the Bureau of Mines, the surplus has been now used in large quantities on various public projects with remarkable success, thus completely disproving the opinions given in various quarters following the armistice that it was unfit for industrial use, dangerous to store, and should be thrown away. Notwithstanding the success attained it is believed that with a more complete knowledge of its behavior even better results in its use both for military and industrial purposes could be attained. It is particularly desired to know the kind and quantities of products it yields on explosions. These are known broadly but it is also now known that they vary with the different conditions under which the TNT is exploded and this study has been made to gain more precise information regarding these conditions. It is already known that among the products are considerable quantities of carbon monoxide, hydrogen and some hydrocarbons, such as methane, together with free carbon in a soot-like form. Hence TNT is not suitable for use in underground work or close places because the gas evolved is poisonous and inflammable and can form explosive mixtures with the atmosphere in these close places.

A new map of the vegetation of North America: John W. Harshberger, Ph.D., professor of botany, University of Pennsylvania.

On the vibrations of rifle barrels: Arthur Gordon Webster, Sc.D., LL.D., professor of physics, Clark University.

FRIDAY, APRIL 23

Afternoon Session—2 o'clock

HAMPTON L. CARSON, M.A., LL.D., vice-president, in the chair

Symposium on Psychology in War and Education

Introduction: LIGHTNER WITMER, Ph.D., director of the Psychological Laboratory and Clinic, University of Pennsylvania.

Methods: J. MCKEEN CATTELL, editor of SCIENCE. The speaker reviewed the development of experimental and quantitative methods in psychology, and especially the transfer of its main concern from introspection to the study of individual differences in behavior. This has made possible the applied psychology which was of such service to the nation in time of war and will prove of increasing value in education and in industry. Efforts to alter conduct by a direct appeal to consciousness, as undertaken, for example, by the churches, the schools and the law courts, have yielded small results. But individuals can be selected for the work for which they are fit and can be placed in the human and physical environment in which their reactions are what we want. By cooperation with other sciences, it is also possible for psychology to change the environment, and behavior can be controlled more effectively by a change in the environment than by a change in the constitution of the individual. The older psychology must be put in its proper place; it can not be altogether discarded. As far as production goes, consciousness may be only a spectator; but it is the ultimate consumer.

Psychological examining and classification in the United States army: ROBERT M. YERKES, Ph.D., chairman of Division of Research Information, National Research Council, Washington. (By invitation.) Psychological examining in the United States army was made possible by the prompt action of American psychologists, who individually and collectively, in committees and conferences, formulated plans, prepared methods and induced the army and the navy to utilize psychological service. The methods of examining which were finally adopted are based upon principles previously used but they exhibit also new and important features which constitute significant contributions to the technique of practical mental measurement. The personnel for psychological examining was carefully selected in accordance with qualifications and the men were especially trained at the Camp Greenleaf School for Military Psychology. This intensive training in the rudiments of military science and military psychology ranks next in importance in its relations to the final success of the service to the superior quality of the army's psychological personnel. The initial purpose of examining was the discovery and prompt segregation or elimination of men of markedly inferior intelligence. The uses which were actually made of results of psychological examinations were extremely varied and covered the classification of men to facilitate military training, the selection of men of superior ability for training as officers or for special tasks, the segregation and special assignment of men whose intelligence was inadequate to the demands of regular military training, and finally the elimination of the low-grade mental defective. It was the demonstration of values in these and several other directions that converted military skepticism concerning the serviceability of psychology into belief and active support. After the official trial of methods approximately 75 per cent. of the officers concerned believed that they should be used further. On the signing of the armistice 90 per cent. of the officers of the army, if we may judge by the opinions of the commanding officers of camps and divisions, were highly favorable to the psychological service.

The relation of psychology to special problems of the army and navy: RAYMOND DODGE, Ph.D., professor of psychology, Wesleyan University. (By invitation.) To help mobilize the human factors that were needed by the army and navy to win the war, that was the task for which the psychologists of the country were organized under the leadership of the National Research Council. Two great achievements stand to their credit; first the sorting of the conglomerate of the draft army with respect to general intelligence under Major Yerkes; and second the discovery, indexing and assignment of trade experience, special skill and presumptive ability to perform the tasks needed by a modern army, under Colonel Scott. These achievements are regarded by experts as an important factor in the supposedly impossible undertaking of building a great fighting organization in a few months time. New demands were made on human nature during the late war, many of which were only imperfectly understood. The task of flying is a good illustration. Psychologists cooperated with the Air Service in studying the effects of high altitudes and in discovering test indicators of the ability to stand them. They were responsible for the mental tests in picking those who could learn to fly with a minimum expense and risk. Gas warfare and adaptation to the wearing of gas masks, the de-

velopment and maintenance of morale, the development of the less fit recruits, the acceleration of training and the reeducation of the wounded, the detection of promising candidates for special schools, finding human material for the best and quickest development of submarine listeners, of lookouts, and of gunpointers, all these were primarily psychological problems and the psychologists cooperated in their military solution. We had no military system developed to provide for these details. The enemy military authorities confidently regarded our lack of it as prohibiting effective participation in the war. The rapid development of a great fighting machine needed all our knowledge of human capacity and individual differences, and all our relevant laboratory techniques. Psychology took an honorable and not inconspicuous part in the democratic triumph of meeting a national crisis by the mobilization of the experience of non-military experts. To some of us it seems that we are again facing a national crisis in which the major symptoms are psychological. Again the enemy counts on our lack of organization. Our salvation depends on the re-mobilization of the expert experience of citizens.

Relation of psychology to the National Research Council: James R. Angell, A.M., Litt.D., chairman of the National Research Council, Washington (by invitation). The National Research Council is based upon forty or more scientific societies representing physics, astronomy, mathematics, engineering in all its branches, chemistry and chemical technology, geology and geography, medicine, biology and agriculture, anthropology and psychology. The council is organized to promote the interests of pure and applied science (both inside and outside the industries) in every practicable way throughout the United States. Its relation to psychology is precisely similar to its relation to the other sciences mentioned. In each instance, the supporting scientific societies elect representatives who compose the several divisions of the council, and these in turn, comprising as a rule about twenty men, selected for their eminence in their particular branch of work, come together and determine the special needs and opportunities for the improvement of research in their own fields. Special attention is paid to the possibilities of bringing about effective cooperation among research men and research agencies. Scientific investigation has hitherto been largely individualistic, and the most pressing need at the present moment is not so much the expansion of research agencies, although this is desirable, as the more effective employment of those already in existence. The Division of Psychology and Anthropology has formulated a number of cooperative projects, of which two may serve as illustrations. One of these has to do with the examination of the mental and physical characteristics of four important alien groups, *i. e.*, Mexicans, Scandinavians, Sicilians and Japanese. Some two thousand of each group are to be scientifically examined by the best modern methods. The result of this study ought, as regards these special races, to give us far more accurate and useful knowledge than we now have of the problem which confronts us in our present attempt to assimilate these racial stocks into our native American people. The other project contemplates an expedition to Central Africa in the upper regions of the Congo for a study of the same scientific sort upon the aboriginal natives who are still to be found there largely untouched by the influences of civilization. The expedition will be sent out under a psychologist who commands the languages of the regions, and with the methods at present available, scientific results may be expected of a character hitherto wholly impossible.

Psychological methods in business and industry: Beardsley Ruml, Ph.D., Philadelphia. (By invitation.)

The individual in education: Arthur J. Jones, Ph.D., professor of education, University of Pennsylvania. (By invitation.)

FRIDAY EVENING, APRIL 23

Reception from 8 to 11 o'clock in the hall of the Historical Society of Pennsylvania.

Robert Williams Wood, LL.D., professor of experimental physics, Johns Hopkins University, spoke on "Invisible light in war and peace" (with experimental illustrations).

Arthur W. Goodspeed

(To be continued)

SCIENCE

A Weekly Journal devoted to the Advancement of Science, publishing the official notices and proceedings of the American Association for the Advancement of Science

Published every Friday by

THE SCIENCE PRESS

LANCASTER, PA. GARRISON, N. Y.

NEW YORK, N. Y.

Entered in the post-office at Lancaster, Pa., as second class matter